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Ethanol extract grapefruit peel (*Citrus maxima* Murr.) gel formulations with gelling agent durian seed gum and carboxy methyl cellulose

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ABSTRACT

This research aims to investigate the best gel formula of grapefruit ethanol extracts (Citrus maxima Murr.) with gelling agent combination durian seed gum and carboxy methyl cellulose (CMC). Durian seed gum was isolated with centrifuge and then combined with CMC-Na in five formulas. Evaluation material of topical gel that is its homogeneity, pH, stability testing, and irritation of the volunteers. All formula gel preparations its homogeneity, pH, stability, irritation, and the ability to moisturize the skin. Formula V with a comparison of durian seed gum and CMC-Na 3:2 is a good formula.

Keywords: durian seed gum, carboxy methyl cellulose, topical gel

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INTRODUCTION

In General, the fruit of pomelo consists of meat and skin parts. Part of the edible flesh of the fruit is called an endocarp. Endocarp made up of segments called carpel or local. The endocarp is surrounded by citrus sections called skin. The skin of citrus fruits consists of flavedo and albedo. Flavedo is part outer skin, which is located at the bottom of the epidermis layer and contains oil sacs and kromoplas, while the skin of the inner part of which is called the albedo is a network layer of foam [23].

Flavedo contain oil life, pigment, carotenoids and steroid compounds, while albedo is rich in compounds, cellulose, hemicellulose, lignin, phenolic, and pectat. The composition of the wall segments, juice pouches, and the center of the fruit is not much different from the albedo. Most of the sugar and citric acid found in fruit juice in addition to the nitrogen components, lipids, vitamins, phenolic compounds, and inorganic compounds [23]. The contents of flavonoids and lycopene enables grapefruit have activities antioxidant can inhibite premature aging [24].

Formulation of gel preparations underway to enhance the effectiveness of the use of extracts of grapefruit skin on human skin with durian seed base carboxy methyl cellulose and gums. CMC is a synthetic cellulose to have the merit of them that is able to generate a natural gel, clear, colorless and tasteless cold, stable at pH 3-11 and got a good resistance against microbial attack. Durian seed gum is gum obtained from the seeds of the durian which gum

has been widely used as a thickener, stabilizer and emulsion additive in various food industries and pharmaceuticals [21,22].

The gel is a topical preparation that is easily appliedto the skin and has an attractive physical appearance compared to other topical preparations. Its use is preferred because these supplies, gel contains water that is cooling, soothing, moisturizing, easy usage, easily penetrate in the skin, thus giving a faster healing effect in accordance with the base used [16,17].

MATERIALS AND METHODS

Material

This research was conducted in the Formulation Technology Laboratory and Research Laboratory, Faculty of Pharmacy, University of Sumatera Utara. The tools used in this research are skin analyzer dan moisture checker (Aramo Huvis), analytical balance (Sartorius), and spectrophotometer UV/Vis (Shimadzu). The materials used in this research are methyl paraben, sodium pyrosulfit and glycerine from Merck and grapefruit. Grapefruit obtained from a grapefruit farmer in Matangglumpangdua Village, Bireuen District, Nanggroe Aceh Darussalam Province. Determination of grapefruit was done in Herbarium Medanese, University of Sumatera Utara and gives the following systematic:

Kingdom : Plantae
Divisi : Spermatophyta
Class : Dicotyledoneae
Ordo : Rutales
Genus : Citrus
Species : *Citrus maxima* Merr.

Methods

Grapefruit Peel Extraction

Grapefruit as much as 10 kg washed and grapefruit peel are collected, cleaned, drained, then cut longitudinally. The skin is then dried in the drying cabinet at a temperature of ± 60°C until dry, and then stored in plastic bags to prevent the effects of moisture [1,2]. Preparation of grapefruit peel ethanolic extract is done by maceration. A total of 200 g of powder simplicia put into maceration bottles, covered with 75 parts of ethanol, closed and left for 5 days protected from light and stirring often. Then filtered, residue washed with ethanol to obtain 100 parts, macerate transferred into a closed vessel, left in place the cool, protected from light for 2 days, then filtered. Macerate obtained,then evaporated at low temperature and pressure so that obtained the dried extract [3,4].

Durian Seed Gum Isolation

Isolation of Gum is done in the following way: durian seed are washed, finely blended with water 1:10 then set the pH 12 with the addition of NaOH, saved directly into the refrigerator for 24 hours, then centrifuged with speed 9500 ppm during 15 minutes. The centrifuges result is then added ethanol 1:2 and then stored in the refrigerator for 24 hours, then supernatan that form is filtered with a cloth and deposition of ethanol added to the submerged, after harden, then filtered back with fabric and stored in a desiccators [5,6,7].

Gel Formulation

Preparations were made based on the standard formula of CMC-Na gel base is as follows [8,9,10]

R/ CMC-Na	5 g
Glycerin	10 g
Propilenglicol	5 g
Aquadest ad	100 ml

A modified gel formula is made with various concentrations of durian seed gum and CMC-Na, each 100 g, with formula as in Table 1.

Tabel 1: **Gel Formula Preparations**

Formula	CMC (g)	Durian seed gum (g)	Extract (g)	Propylene glycol (g)	Aquadest (ml)
Formula I	5,00	-	1,00	2,50	100
Formula II	-	5,00	1,00	2,50	100
Formula III	2,50	2,50	1,00	2,50	100
Formula IV	3,00	2,00	1,00	2,50	100
Formula V	2,00	3,00	1,00	2,50	100

Each formula is added as a preservative methylparaben 0.1% = 0.05 g

Weighed materials in accordance with the weighting of each formula. Into hot porcelain mortar filled with 20 ml of boiling water, and added little by little the gelling agent (CMC or durian seed gum) while crushing until it formed a transparent mass. Furthermore added propylene glycol and methylparaben.

Homogeneity

Examination methods: Observations of its homogeneity by durian seed gel done by applying a certain number of preparations on a piece of transparent glass and covered with glass objects, then observed. Preparations must demonstrate a homogeneous composition and no visible presence of grain [10,11].

Determination of pH

pH determination is done by using a pH meter as follows: Tool first calibrated using standard encompasses solution is neutral (pH 7.01) and the pH of the solution encompasses acidic (pH 4.01) to position the needle indicates the pH price above. The electrode is then washed with distilled water, and dried with a paper tissue. A sample created in concentrations of 1% that weighs 1 gram of material diluted with distilled water to 100 ml in a container, then the electrode is dipped in the solution, the needle left to move to a position of constant. The number shown in pHmeter is pH price [10,11].

Determination of the power spread preparations

As many as 500 mg dosage was placed in the middle of the petri dish which has been fitted with a millimeter paper block. Then another covered with glass. Left on for 1 minute and measured the diameter of the material of which spread from two sides [11,12].

Observation of the stability of the preparation

Each formula preparation put into a transparent container closed part of it. Formula is stored at room temperature, andobserved every week until 12 weeks. It is observed in the form of changes in consistency, color, smell, and the spread of material resources [10,11].

Testing irritation against the skin of volunteers

Irritation test performed on 6 people volunteer with how little material is applied on the back of ears volunteers, then left on for 24 hours and see the changes that occur, if there is irritation of the skin will appear reddened, itchy, and rough. Criteria of volunteers who made the test panels on the irritation is as follows: 1. the able-bodied Women 2. Age between 20-30 years 3.Healthy physical and spiritual 4. No history of allergy-related diseases 5. Willing to volunteer [13,14].

Gel Formulation Result

Homogeneity Preparations Result

The results of the experiments have been done on the preparation of the gel that is formulated using grapefruit peel ethanolic extracts the with a variety of concentrations, there was no grain on a piece of glass, then the material is said to be homogeneous [15].

Determination of the pH Value Result

Preparations pH values determined using the pH meter that the average pH of the entire preparations tested ranged between 6,3–6,7 means eligible for material of skin moisturizer because the pH requirements for material of skin moisturizer is 5-8 [16,17].

Spread the Power Test Results

The results of measurements of the spread of power gel preparations formulated with different concentration

ofgrapefruit peel ethanolic extractsbetween 5.10–5.28 cm means a good criteria for material gels because a good spread of power criteria for material of skin is 5-7 [11,12].

Stability Observation of the Preparation Result

Each gel preparation is obtained with the consistency of a thick gel preparation, with the addition of ethanol extracts of grapefruit skin respectively 1%, 1.5%, and 2% are brown to blackish brown, while the gel is colorless blanko (transparent). Gel preparations from all formulas are not going change in color, smell and shape after 12 weeks of storage at room temperature [11,12].

Irritation Test of the Volunteers

The invisible presence of side effects in the form of redness, itching, and rough on the skin caused by the material. Then it can be inferred that the gel preparations formulated using grapefruit peel ethanolic extracts is not irritating to the skin [10,18].

Test the ability to skin moisturizing preparations

The ability to skin moisturizing preparations conducted on volunteers who have the same criteria with volunteers to test using a tool such as skin irritation, moisture analyzer, in the following way: first hand back washed clean, then dried until it is completely dry, checked percent humidity before moisturizing gel preparation applied topically, and make a note of the indicated percentage, the preparation of the gel is applied evenly on the backs of the hands of ± 1 gram, It is left up to the preparation of the gel really permeated the skin approximately 1 hour, checked percent humidity once smeared gel preparations, noting the percentage shown, repeated these preparations gel re-settled, checked back percent these two, and repeat up to these three, make a note of the indicated percentage, calculated average percentage is obtained. The results obtained it was concluded the ability to skin moisturizing [19,20]. Preparations based on the criteria in Table 2.

Table 2: Humidity Scale Skin Moisture Analyzer FCM-1

Humidity (%)	Description
<40	Less moist
40-60	Moist
>60	Very Moist

RESULTS AND DISCUSSION

Examination of homogeneity preparations Result

Homogeneity observation can be done by applying a piece of glass on the preparations, then flattened out, if there is no grain-grain on a piece of glass, then the material can be said to be homogeneous. The results of the experiments have been done on the preparation of the gel that is formulated using the durian seed gum with a variety of concentrations, there was no grain-grain on a piece of glass, then the material is said to be homogeneous [15].

Determination of the pH Value Result

Preparations pH values determined using the pH meter. Experimental results obtained can be seen in Table 3 shows that the average pH of the entire preparations tested ranged between 6,3–6,7 means eligible for material of skin moisturizer because the pH requirements for material of skin moisturizer is 5-8 [12,16]. Look there are no significant influence among the formula using a variation of the concentration of different durian seed gum.

Table 3: pH Measurement of Formula

No.	Formula	pH			
		I	II	III	Mean
1.	Formula I	6,6	6,8	6,7	6,7
2.	Formula II	6,2	6,3	6,4	6,3
3.	Formula III	6,7	6,6	6,5	6,6
4.	Formula IV	6,5	6,4	6,6	6,5
5.	Formula V	6,5	6,3	6,4	6,4

Spread the Power Test Results

Spread the power test is done to find out the easy of deployment preparations gel when used. The bigger the spread,

the easier power gel preparations when applied topically. The results of measurements of the spread of power gel preparations formulated using gum durian seed with different concentration variation can be seen in Table 4 shows that the power of the average spread throughout the preparations tested ranged between 5.10–5.28 cm means a good criteria for material gels because a good spread of power criteria for material of skin is 5-7 [11,13]. There is little visible difference power spread preparations with higher concentrations of gum producing greater spread, although the difference is not very large, and completely still in a good criteria.

Table 4: Power Measurement Data Put the Newly Created Preparations

No.	Formula	Spread of Power (cm)			
		I	II	III	Mean
1.	Formula I	5,00	5,10	5,20	5,10
2.	Formula II	5,30	5,25	5,30	5,28
3.	Formula III	5,10	5,10	5,25	5,15
4.	Formula IV	5,10	5,15	5,10	5,12
5.	Formula V	5,10	5,20	5,25	5,18

Stability Observation of the Preparation Result

The results of observation of the stability of the preparation of the gel formula that was created by using a durian seed gum in different variations of concentration, in storage until 12 weeks, and observed every week can be seen in Table 5. Damaged or whether a material that contains ingredients that are easily oxidized can be observed with the color change also changes the smell, to overcome the damage of materials due to oxidation can be done by adding an antioxidant ingredients such as sodium metabisulfit. Damage can also be caused by fungi or microbes, to cope with it can be done the addition of anti-microbial (preservatives) such as nipagin. Based on the data in table 12 above, it can be seen that the formula I and II in week 4 has undergone a change due to higher moisture content than other formulas, while the formula III, IV and V are stable until the 12th week havenot suffered damage [11,12].

Tabel 5: Observations on the Stability of the Preparation

No.	Formula	Observations during storage														
		Newly made			1 week			4 weeks			8 weeks			12 weeks		
		F	S	C	F	S	C	F	S	C	F	S	C	F	S	C
1.	Formula I	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+
2.	Formula II	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+
3.	Formula III	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4.	Formula IV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5.	Formula V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Description:F : Form; S : Smeel; C : Color; + : Changed; '-: No Changed

Irritation Test of the Volunteers

The use of cosmetics that are not good on the skin can cause a range of reactions (side effects). To find out or no such side effects then performed a test of irritation against the skin. Testing is done only on the formula III as the best formula obtained results as Table 13. Against the skin irritation test to know or no side effects, done by cosmetics smeared on the forearm or 6 people behind the ears volunteers, then left on for 24 hours and see the changes that occur in the form of redness, itching and rough on the skin [10,11]. Table 6 shows that the invisible presence of side effects in the form of redness, itching, and rough on the skin caused by the material. Then it can be inferred that the gel preparations formulated using gum durian seeds with 5% concentration is not irritating to the skin.

Tabel 6. Skin Irritation Test of the Volunteers (Formula III)

No.	Skin Irritation Test	Volunteers					
		I	II	III	IV	V	VI
1.	Redness of the skin	-	-	-	-	-	-
2.	Itching of the skin	-	-	-	-	-	-
3.	The skin becomes rough	-	-	-	-	-	-

Ability to Skin Moisturizing Result

Testing the ability to skin moisturizing preparations done by measuring the percent of moisture the skin after using preparations use the Skin Moisture Analyzer against 6 people volunteer. The results obtained can be seen in Table 7 shows that the preparation of the gel that is formulated using the gum with an enormous variety of durian seed

concentration showed no difference in the percentage increase in the moisture of the skin which is very significant. Formulas I, II, III, IV and V, contains the same amount of grapefruit ethanol extract, but seen data obtained an increase in humidity by increasing the concentration of durian seed gum (Formula II dan Formula V) are used, possibly because the skin pores getting covered with an increased concentration of durian seed gum that is used in the formula so as to reduce the water content evaporate on the skin.

Tabel 7. Percent Skin Moisture Measurement After Use of the Gel Formula

Formula	Volunteers	Before (%)	After (%)	Moisture Scale	Increase of Humidity (%)
Formula I	I	36,80	56,56	Moist	53,70
	II	30,00	49,06	Moist	63,54
	III	31,20	51,56	Moist	65,27
	IV	30,30	47,06	Moist	55,32
	V	37,20	56,83	Moist	52,77
	VI	38,00	56,93	Moist	49,82
The average percentage of increase in the moisture of the skin after using the material of the formula I = 56.74%					
Formula II	I	36,80	59,16	Moist	60,77
	II	30,00	51,66	Moist	72,20
	III	31,20	54,16	Moist	73,60
	IV	30,30	49,66	Moist	63,91
	V	37,20	59,40	Moist	59,67
	VI	38,00	57,12	Moist	56,57
The average percentage of increase in the moisture of the skin after using the material of the formula II = 64,45 %					
Formula III	I	36,80	58,11	Moist	57,92
	II	30,00	50,61	Moist	68,71
	III	31,20	53,11	Moist	70,24
	IV	30,30	48,61	Moist	60,44
	V	37,20	58,38	Moist	56,94
	VI	38,00	58,48	Moist	53,89
The average percentage of increase in the moisture of the skin after using the material of the formula III = 61,36 %					
Formula IV	I	36,80	56,75	Moist	54,22
	II	30,00	49,25	Moist	64,18
	III	31,20	51,75	Moist	65,88
	IV	30,30	47,25	Moist	55,95
	V	37,20	57,02	Moist	53,28
	VI	38,00	57,12	Moist	50,32
The average percentage of increase in the moisture of the skin after using the material of the formula IV = 57,30 %					
Formula V	I	36,80	58,37	Moist	58,62
	II	30,00	50,87	Moist	69,58
	III	31,20	53,37	Moist	71,07
	IV	30,30	48,87	Moist	61,30
	V	37,20	58,64	Moist	57,63
	VI	38,00	58,74	Moist	54,58
The average percentage of increase in the moisture of the skin after using the material of the formula V = 62,13 %					

CONCLUSION

The formula I use only CMC-Na consistency a bit louder and less comfortable at the time compared to other formula is applied. Formula II, which uses only durian seed gum have concentrated color, but gives the highest humidity in the skin, so the formula V is summed up best in comparison with CMC-Na and durian seed gum 3:2 that gives consistency and good humidity.

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